Vascular injury following microendoscopic lumbar discectomy treated with stent graft placement

Case report

HIROSHI UEI, M.D., YASUAKI TOKUHASHI, M.D., MASASHI OISHIMA, M.D., AND YOICHI MIYAKE, M.D.
Department of Orthopaedic Surgery, Nihon University School of Medicine, Tokyo, Japan

The risk of great vessel injury is low in microendoscopic lumbar discectomy applied in a favorable visual field. However, it is important to be aware of the depth of the pituitary rongeur. In this article, the authors report the case of a 55-year-old woman with lumbar disc herniation who underwent microendoscopic discectomy and subsequently presented with an aneurysm and arteriovenous fistula located at the bifurcation of the right common iliac artery. The patient was treated with endoscopic placement of a stent graft and recovered uneventfully.

Key Words • lumbar disc herniation • microendoscopic lumbar discectomy • vascular injury • stent graft • arteriovenous fistula • pituitary rongeur

Microendoscopic discectomy is a low-invasive procedure compared with conventional surgery and has fewer complications due to the favorable visual field. Thus, this procedure has recently been increasingly applied in Japan. However, only one case of microendoscopic discectomy–induced great vessel injury has previously been reported, suggesting that this possible complication has not been fully recognized. Here, we describe a case of great vessel injury in a patient treated with microendoscopic discectomy for lumbar disc herniation.

Case Report

A 55-year-old woman visited a physician for chief complaints of pain and numbness in her left leg. She was diagnosed with lumbar disc herniation and was treated conservatively for 4 months. However, the symptoms slowly increased and the patient was referred to our hospital. She had no notable familial medical history. She had undergone total hysterectomy for hysteromyoma at 32 years of age.

The patient was referred for neurosurgical treatment after failure of conservative therapy. The MRI study that had been performed 4 months before the patient presented to us showed disc herniation on the left side at the L5–S1 level (Fig. 1). Microendoscopic discectomy was performed in July 2011, 1 month after referral. The surgery was performed with the patient in a prone position and under general anesthesia. Oozing of blood was noticed about 1 minute after initiation of hernia excision using a pituitary rongeur, and blood pressure reduction, tachycardia, and reduction of end-tidal CO$_2$ occurred about 1 minute later. Loading of pressure on the lung with a head-down tilt normalized blood pressure, pulse, and end-tidal CO$_2$, and hemorrhage stopped and surgery was completed. The operating time was 91 minutes and intraoperative blood loss was 185 ml. The patient’s vital signs were stable after surgery, but her hemoglobin level decreased to 9.2 g/dl.

The patient’s hemoglobin level further decreased to 6.1 g/dl 2 days after surgery, but the volume of aspirated drainage was only 30 ml over 2 days. Thus, an emergency abdominal contrast-enhanced CT scan was performed. The scan showed an aneurysm of 3 × 4 cm located at the bifurcation of the common iliac artery and enhancement of the right common iliac vein distal to the inferior vena cava, suggesting the presence of an arteriovenous fistula (Fig. 2). We considered surgery for this condition and consulted vascular surgeons. Laparotomy was also considered, but because of the history of subileus following hysterectomy, stent graft treatment was selected. Angiography performed under general anesthesia showed extravascular leakage from the bifurcation of the common iliac artery and an arteriovenous fistula; a Zenith...
Endovascular Graft (Cook Medical Inc.) was placed in the distal right common iliac artery and proximal right external iliac artery (crossing the common iliac artery bifurcation) (Fig. 3). Postoperative contrast-enhanced CT confirmed resolution of the aneurysm and arteriovenous fistula (Fig. 4). The patient recovered well from the procedure and was discharged on postoperative Day 7. She has been followed up for over 18 months and has had no graft occlusion or recurrence of lumbar disc herniation.

Discussion

The incidence of great vessel injury during excision of herniated lumbar disc material is low (0.039%–0.14%), but when massive hemorrhage occurs, the mortality rate is greater than 50% due to hemorrhage-induced shock and heart failure. Papadoukas et al. reported on 99 patients in whom great vessel injury occurred during excision of herniated disc material; 30 patients (30%) had vascular laceration; 66 (67%) developed an arteriovenous fistula; and 3 (3%) developed a false aneurysm. The diagnosis was made within 24 hours after injury in only 38 cases (38%). This shows that a diagnosis cannot necessarily be made immediately after injury; this may be because a patient can have a large-volume hemorrhage into the retroperitoneal cavity while the hemorrhage in the surgical field is small. Serious retroperitoneal hemorrhage occurs, but discovery of intraoperative vascular injury may be delayed, even when a great blood vessel is injured, because surgery is performed with the patient in the prone position, and an arteriovenous fistula is formed by simultaneous injury of the artery and vein and may reduce the blood loss to some extent. Vascular injury is diagnosed based on unexpected progression of anemia after surgery; signs of heart failure, such as tachycardia, shortness of breath, and swelling of the lower limbs; abnormal abdominal distention; and asymmetry of the femoral artery pulses. When the volume of hemorrhage is small, vascular injury may be difficult to diagnose in the early stages. The delayed discovery of vascular injury in our patient may have been due to the small volume of hemorrhage in the surgical field, rapid stabilization of temporarily worsened vital signs, and arteriovenous fistula formation.

The anatomical relationships of blood vessels injured in discectomy have been investigated previously, with vascular injury at the L4–5 level most frequently noted. At this level, injury occurs in various patterns because the right common iliac artery and left iliac vein overlap on the median line, and the aorta and inferior vena cava

Fig. 1. Preoperative sagittal (left) and axial (right) T2-weighted MR images showing disc herniation on the left side at L5–S1.

Fig. 2. Coronal (left) and axial (right) abdominal contrast-enhanced CT images showing a 3 × 4-cm aortic aneurysm located at the bifurcation of the right common iliac artery (large arrow) and enhancement of the right internal iliac vein distal to the inferior vena cava, suggesting the presence of an arteriovenous fistula.
Risk of great vessel injury in microendoscopic discectomy

bifurcation are close to the intervertebral region. Injury of the right common iliac artery or left iliac vein was frequently observed. At the L5–S1 level, the injury pattern is more diverse and arteriovenous fistula formation may occur. Vascular injury at the L4–5 and L5–S1 levels is thought to occur in many cases as a result of pressure on the thoracoabdominal region while patients are in the prone position during surgery; in this position, the abdominal great vessels are compressed and lose mobility due to being pressed against the vertebral body, making them more likely to be injured.2,11,19 In contrast, some authors who have studied the prevertebral vascular distribution have reported no difference between the prone and supine positions.1,7

Factors inducing great vessel injury during excision of herniated disc material include rupture of the anterior intervertebral disc, defects of the anterior longitudinal ligament and anterior annulus fibrosus, the patient’s physique and position during surgery, medical history of abdominal surgery, surgery for recurrent disc herniation, and experience of the surgeon.8,18,20 Thin pituitary rongeurs are used for removal of the herniated material in microendoscopic discectomy because of the narrow visual field, and they can readily perforate the anterior vertebral disc and anterior longitudinal ligament. Moreover, the depth of pituitary rongeur insertion is difficult to determine in 2D video camera images. Limitation of treatment to a region within 3 cm from the posterior disc has been recommended to prevent vascular injury in some reports.5,21

In our patient, perforation of the anterior intervertebral disc and anterior longitudinal ligament was not felt during surgery, but insertion of the pituitary rongeur deeper than usual was found in the video recording when it was viewed after surgery. Measures to prevent vascular injury should include marks to identify the depth of pituitary rongeur insertion and limiting insertion to the depth at which the pituitary rongeurs are opened.

Various treatments can be performed for vascular injury, including ligation of arteries and veins, closure of fistulas, arterial bypass, and patch plasty.13 Treatment with stent graft placement, coil embolization, balloon occlusion, and glue injection has also been reported.9,17,20,22 We did not perform laparotomy because the patient had a history of subileus after hysterectomy and selected stent graft placement. The patient rapidly recovered and early discharge was possible.

The great vessels were injured in our case during the excision of herniated disc material in microendoscopic discectomy, but fortunately an arteriovenous fistula was formed because the artery and vein were simultaneously injured, and this reduced hemorrhage to a relatively small
volume. Diagnosis of vascular injury was delayed, but abdominal contrast CT permitted diagnosis and treatment before progression to a more serious condition. However, if the risk of great vessel injury in microendoscopic discectomy had been fully considered, it might have been possible to diagnose vascular injury based on intraoperative signs, such as the sudden reduction of blood pressure, tachycardia, and reduction in end-tidal CO₂ concentration, and the decrease in hemoglobin after surgery.

Conclusions

Great vessel injury and arteriovenous fistula are potential complications of microendoscopic discectomy. Avoidance of a serious complication requires rapid diagnosis and treatment; toward this end, it is important not to overlook changes in vital signs. Stent graft placement may be appropriate treatment for this condition.

Disclosure

No funds were received in support of this work. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.

Author contributions to the study and manuscript preparation include the following. Concept and design: Uei. Drafting the article: Uei. Critically revising the article: all authors. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Uei. Administrative/technical/material support: Oshima, Miyake. Study supervision: Tokuhashi.

References


H. Uei et al.